National Aeronautics and Space Administration

Lyndon B. Johnson Space Center
Houston, Texas

Underwater exploring

As part of the JASON Project, area students explore the Florida Keys without getting wet. Story on Page 3.

Inspecting debris

A team of employees in Space and Life Sciences study space debris impacts on Mir equipment. Photo on Page 4.

Space News Roundup

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NASA Photo

The STS-77 astronauts take time out at the slidewire baskets on the emergency egress system during the Terminal Countdown Demonstration Test at Kennedy Space Center. From left are, Mission Specialist Dan Bursch, Commander John Casper, Pilot Curt Brown and Mission Specialists Mario Runco, Andy Thomas and Marc Garneau. Endeavour is scheduled to liftoff from Launch Pad 39B May 19.

Managers clear *Endeavour* for May 19 launch

By James Hartsfield

Following a flight readiness review Tuesday, shuttle managers cleared the way for a 5:30 a.m. CDT May 19 liftoff of Endeavour on STS-77.

Work on *Endeavour* at KSC has continued to go smoothly, and the STS-77 launch countdown is now scheduled to begin at 3 a.m. CDT Thursday. The crew of STS-77 — Commander John Casper, Pilot Curt Brown and Mission Specialists Andy Thomas, Dan Bursch, Mario Runco and Marc Garneau — will arrive in Florida at 8 a.m. CDT Thursday to prepare for the launch.

Working with two experimental satellites, STS-77 will feature more rendezvous and station-keeping activities than ever performed on a single shuttle flight. The first major event on the flight will be the deploy of the Spartan-207 satellite carrying the Inflatable Antenna Experiment on the second day of the mission. Following deploy, Casper will keep *Endeavour* in close proximity to the Spartan for more than four hours while the antenna experiment is inflated and equipment in the cargo bay is used for investigations. After the antenna science package is jettisoned, *Endeavour* will return to Spartan the next day to retrieve it and place it back in the cargo bay for the return to Earth.

On Day 4 of the flight, the next satellite, called the Satellite Target Unit, will be deployed. The STU is used as a target for investigations with the Passive Aerodynamically Stabilized Magnetically Damped Satellite experiment, or PAMS, which will characterize a new method for stabilizing satellites in orbit. To conduct the experiment, *Endeavour* will station-keep with the satellite following its deployment and then return to within a half-mile of the STU on two separate occasions later in the mission.

Also aboard *Endeavour* will be the Spacehab module, making its fourth shuttle flight and carrying more than one and a half tons of secondary experiment equipment. In addition, other secondary experiments to be mounted in *Endeavour*'s cargo bay and in the crew cabin will include investigations ranging from biological studies to space technology development.

An on-time launch of *Endeavour* May 19 would lead to a planned landing of STS-77 in Florida at 6:07 a.m. CDT on May 29.

Work this week on *Endeavour* at Launch Pad 39B included close-outs of the engine compartment and the installation and checkouts of space suits that would be needed in a contingency.

Meanwhile, work continues to ready *Columbia* for a mid-June

Please see ***COLUMBIA***, Page 4

Priroda work begins today

Mir 21 Cosmonaut Researcher Shannon Lucid begins science activities in the Priroda module of the Russian Mir Space Station today after a week of preparing Priroda and stowing supplies that arrived on a Progress vehicle.

"We have been real busy here," Lucid said during a status briefing Wednesday. "Priroda got here with a lot of scientific equipment we will be working with in the next month. And like moving into a new house, you can't get to work instantly. You have to unpack and repack and get everything situated.

"We worked a lot on Priroda and got to a point where we couldn't do much because we had packing material we had to do something with before we could really get down to work. Progress got here and brought up more supplies and as soon as we get Progress unloaded, we will load up all the packing material from Priroda into Progress. Progress will then be sent back down to Earth and we will be able to get down to the scientific work in Priroda."

The Progress resupply vehicle attached to a Soyuz rocket was launched from the Baikonur Cosmodrome in Kazakhstan on Sunday and successfully docked with the Russian outpost Tuesday. The Progress brought Lucid and her crewmates—Commander Yuri Onufrienko and Flight Engineer Yuri Usachev—food, clothes, fuel and other supplies to Mir. The docking of the supply vehicle

Please see **LUCID**, Page 4

GANE to gain knowledge, fine tune space station orbit

One of the more important aspects of the International Space Station is keeping the orbiting outpost in a safe low-Earth orbit.

Nestled in *Endeavour*'s cargo bay aboard the PAMS-STU Hitchhiker carrier during STS-77 will be an experiment to help determine how the International Space Station will accomplish the task of staying in orbit.

The station will use the Global Positioning System, or GPS, for not only position, velocity and time information, but attitude determination as well. The experiment, proposed in 1994, is designed to find out whether GPS attitude can be measured to 0.1 degrees or less per axis of rotation. The Global Positioning System Attitude and Navigation Experiment, or GANE, experiment will be used to fine-tune the use of GPS on the International Space Station. GANE will fly off-the-shelf equipment and station-supplied equipment to determine the accuracy with which GPS-derived attitude data can be measured in space.

"We formed a team in August of 1994," said Penny Saunders-Roberts of the Avionics Systems Division and project manager of GANE. "The team worked hard to develop an experiment that met all space station requirements in such a short time."

The team developed an experiment that consists of two independent systems: a GPS receiver/processor and antenna assembly, and an inertial reference unit. Both of these systems will be mounted on a GPS antenna mounting structure attached to the top of the Hitchhiker carrier. The GPS R/P and the IRU will each independently use a crew cabin-located Payload and General Support Computer for command and data storage.

Please see **GANE**, Page 4

JSC helps develop solar refrigerator

Oceaneering Space Systems to collaborate on project

Space-age refrigeration that may cool future astronauts on the moon or space station may someday provide environmentally friendly alternatives for Earth's inhabitants.

JSC and Oceaneering Space Systems signed a Space Act Agreement last week for the development of a solar refrigerator. Under the cooperative research agreement, OSS will provide an advanced prototype refrigerator based on space station technology and JSC will provide a solar array and test the integrated system. Three innovative coolers, or "heat pumps," will be tested over the next year: thermoelectric, Stirling and vapor compression.

NASA is conducting this "dual-use technology" project as part of its investigation of solar heat pumps for missions such as a lunar base. Heat pumps will be used to refrigerate food in a lunar base and to "air-condition" living spaces for astronauts.

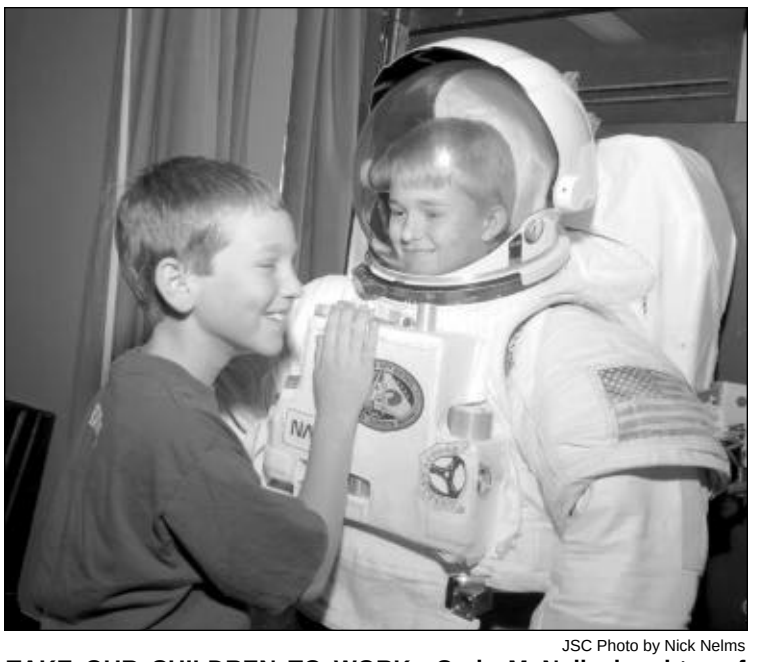
"As advances are made in these aerospace heat pumps, we will be able to apply what we learn to improve refrigerators and air-conditioners on Earth" said Mike Ewert, principal investigator on the project. The most immediate application of solar refrigerators will be in remote areas where there is no electric grid.

The three heat pumps that will be tested, as well as the space age refrigerator cabinet and solar power supply, offer environmental benefits on Earth. The thermoelectric modules are solid state, semi-conductor devices which produce cooling from a DC power source with no moving parts or harmful refrigerants. The Stirling heat pump, which uses helium gas, is a mechanical device which produces cooling when driven by a linear motor. The vapor compression heat pump, similar to those in most refrigerators today, will still use a Freon refrigerant, but it will be the newer type which does not contain chlorofluorocarbons that are believed to harm the ozone layer.

The refrigerator cabinet in which the three heat pumps will be tested incorporates a vacuum superinsulation that limits refrigerator heat gain. The superinsulation currently used is made of evacuated stainless steel panels. The vacuum insulation reduces power consumption, saves energy and makes it more feasible to power with solar photovoltaic panels, which are still fairly expensive.

The solar photovoltaic panels are semi-conductor devices which convert sunlight directly to electricity. Developed for the space program, PV is now finding many uses on earth powering such things as calculators and cellular phone equipment in remote locations. PV panels made of silicone will be used for power.

The solar refrigerator also will "store cold" in phase change materials which release heat when they solidify and absorb heat when they liquefy, the way ice does.



JSC Photo by Nick Nelms

TAKE OUR CHILDREN TO WORK—Cody McNeil, daughter of Valerie McNeil of ILC Dover, helps Bryce Sauser, son of Bruce Sauser of the Crew and Thermal System Division, try on a space suit in a Bldg. 7 lab. Children spent a day at work with their parents last month as part of "Take Our Children To Work Day."